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ABSTRACT

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Female and Minority Representation in College Majors as a Function of Mathematics Requirements

January 1976

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Abstract

Black female, Chicano Female, Asian female and total female enrollment representations as well as total Black, total Chicano and total Asian enrollment representations were determined for undergraduate major areas at seven University of California campuses. The number of mathematics courses required for each major was also determined from the catalog for each campus. Significant negative correlations were found between the number of math courses required for majors and the representation of each female group and total group in the major except Asians. A significant positive correlation was found for all Asians while no significant correlation was found for Asian females. Implications for increasing the representation of women and minorities in professional and academic careers are discussed.

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Introduction

The affirmative action regulations have resulted in considerable interest in the general issue of female and minority representation in academic positions. The regulations require the determination of representation of these groups in academic positions as well as the assessment of the availability of qualified women and minorities to fill these positions. The availability pools of qualified women and minorities for many areas, such as the physical sciences, have been estimated as alarmingly small (Carnegie Council, 1975).

Institutional commitments to higher female/minority representation on college faculties have prompted interest in increasing the availability pools. In some cases, this has taken the form of special programs at the undergraduate or graduate level in the context of student affirmative action or comprehensive affirmative action programs (Majer, 1975). One result of such efforts is the recognition of striking differences in female/minority representation across disciplines (University of California, 1975). The most obvious characteristic of this maldistribution is that few women or minorities (with the exception of Asian minorities) are enrolled in physical science or engineering programs at either the undergraduate or the graduate level. It is also apparent that women are overrepresented in many of the humanities areas. While the picture is by no means clear, the superficial evidence

suggests that women and minorities are more seriously underrepresented in the "quantitative" fields of study.

Some investigators have called attention to this apparent trend. Sells (1973) has suggested that mathematics serves as a "critical filter" for entry into the job market. She has noted that undergraduate major fields with heavy mathematics requirements tend to be the fields with greatest career potential, while many of the traditional women's fields (such as literature) have less career potential in today's job market. Sells reports that women entering UC Berkeley as undergraduates are considerably less well prepared in mathematics than entering males. Further, Ernst (1975) has found a disproportionately low female enrollment in mathematics courses at UC Santa Barbara as well as a higher female attrition rate from mathematics course sequences.

These findings parallel the lower than average mathematics preparation among minority students reported by Spurlock (1975). It is reasonable, therefore, to hypothesize that some of the difference in representation of women and minorities in professional fields may be associated with the number of mathematics courses required to complete the major area of study in preparation for these areas.

The present study investigated the relationship between the number of mathematics courses required for undergraduate majors and the representation of women and minorities in those majors.

Method

Subjects

The subjects of this study consisted of all students at seven University of California campuses who declared a major and whose sex or ethnicity was reported to the University Registration Information System. The campuses involved in this study were UC Davis, UC Irvine, UCLA, UC Riverside, UC San Diego, UC Santa Barbara and UC Santa Cruz. Only students enrolled in a major having at least ten students were included in the study. The total number of students sampled was 51,622.

Procedure

The percentage representation of women in each major was computed for each campus. The number of mathematics courses required for graduation in each major was also computed for each campus. This was computed by adding the number of high school mathematics courses plus the number of university level mathematics courses required. The data for all campuses were combined and a Pearson product-moment correlation between the representation of women in majors and the number of math courses required for those majors was then computed.

In addition, the percentage representations of students who identified themselves as Blacks, Chicanos and Asians, respectively, were computed for each major at each campus. Data were combined from all campuses for each group, and the correlation between representation in majors and the number of

math courses required for the majors was computed.

Finally, the representation of Black females, Asian females, and Chicano females, respectively, was computed for each major. Again, data from all campuses were pooled and correlations between representation in majors and the number of math courses required for the majors were computed.

Results

The results of the correlational analysis and significance tests are presented in Table 1. A significant negative correlation between female representation in academic majors and the number of math courses required for those majors was obtained ($r = .567$, $p < .00001$). This correlation corresponds to 32.1% of the variance in female representation in majors accounted for by the number of math courses required. Significant negative correlations were also obtained between the representation of Blacks and Chicanos in majors and the number of mathematics courses required for those majors ($r = -.112$ and $-.116$, $p < .05$). The correlations correspond to approximately 1.2% of the variance in Black and Chicano representation in majors accounted for by the number of math courses required.

There was a significant positive correlation between Asian representation in majors and the number of mathematics courses required ($r = +.144$, $p < .05$) This correlation corresponds to 2.1% of the variance in Asian student representation

in majors accounted for by the number of mathematics courses required.

There was a significant negative correlation between Black female and Chicano female representation in majors and the number of mathematics courses required for those majors ($r = -.204$ and $r = -.221$, $p < .001$). These correlations correspond to 4.2% and 4.9% respectively of the variance in Black female and Chicano female representation in majors accounted for by the number of math courses required for the majors. There was no significant correlation between the Asian female representation in majors and the number of math courses required for the majors ($r = -.048$, $p > .05$).

Table 1

Correlations and Coefficients of Determination between Percentage Representation in Major Field and Number of Mathematics Courses Required in that Major

	r	r^2
All Women	-.567***	.321
Black Women	-.204**	.042
Chicano Women	-.221**	.049
Asian Women	-.048	.002
All Blacks	-.112*	.012
All Chicanos	-.116*	.013
All Asians	+.144*	.021

Note: N = 238 (Number of Major Fields)
* $p \leq .05$
** $p \leq .001$
*** $p \leq .00001$

Discussion

This study seems to confirm that an underlying variable in the distribution of women students among disciplines is the mathematics requirement of the discipline. Although previous studies have noted that comparatively few women are enrolled in the physical sciences, for example, they have not demonstrated mathematics requirements as a factor in this distribution. It is not surprising that mathematics is linked to the choice of field, since women who come to the University of California tend to take fewer mathematics courses in high school than men who come to the University. It has also been argued that women tend to avoid mathematics courses because of a prevailing attitude that mathematics is "unfeminine". Whatever the reason for the decrease in female enrollment in high school math, this seems to carry over to the college level with implications for the choice of major in college. Thus, it appears that mathematics requirements are a critical filter for selection of academic majors.

The implication of these findings for everyone interested in increasing female representation in quantitative fields is that mathematics coursework must be made more attractive to women if we are to increase their representation. The image of mathematics as unfeminine must be dispelled or our image of femininity must be changed to incorporate mathematical achievement. Perhaps the most effective means of making

mathematics attractive to women would be to stress the importance of mathematics in providing access to careers.

Minority representation in the sciences is also lower than in other areas of study. Many of the same arguments have been voiced about this low minority participation in science as were voiced for women. Lack of minority role models in science as well as high school tracking have been used to explain this underrepresentation of minorities in the sciences. It has also been noted that minorities tend to take fewer advanced mathematics courses than whites. This study supports the notion that an underlying factor in the differential minority representation among various major fields of study is the amount of mathematics coursework required for those majors. The notable exception to this trend are Asian students. There was a significant positive correlation between the number of mathematics courses required and Asian representation in a major. This trend would be expected from data on representation in sciences, where Asians are seen to be overrepresented in proportion to their overall enrollment.

The data on Black females and Chicano females indicate a somewhat stronger negative correlation between representation in majors and math requirements than for all Blacks and Chicanos. One can easily hypothesize that the cummulative effect of the factors influencing minorities and those influencing women were acting in this case. The lack of

significant correlation for Asian females could then be explained as the cancellation of the positive "Asian effect" with the negative "female effect".

Two cautions are called for in the interpretation of the minority student results. Although sex data can be regarded as highly reliable, self-reported ethnicity is probably not as reliable. Such data collected in the registration process (as was the data presented here) have been opined to be influenced by the design and wording of the self-reporting form. In addition, minority representation in most majors was very low (less than 10%). This restriction of range leads to a variety of problems associated with small sample variance. Hence, it is possible that restriction of range has influenced the results on minority students.

Conclusion

The implications of this study seem to be that mathematics cannot be ignored as an important factor leading to choice of major. It is important to consider the issue of mathematics preparation in any program attempting to encourage equal educational and, therefore, occupational opportunity. This might take the form of efforts to promote minority and female role models, discourage tracking, or stress the importance of mathematics preparation in future careers.

Summary

Black female, Chicano female, Asian female and total female

enrollment representations as well as total Black, total Chicano and total Asian enrollment representations were determined for undergraduate major areas at seven University of California campuses. The number of mathematics courses required for each major was also determined from the catalog for each campus. Significant negative correlations were found between the number of math courses required for majors and the representation of each female group and total group in the major except Asians. A significant positive correlation was found for all Asians while no significant correlation was found for Asian females. Implications for increasing the representation of women and minorities in professional and academic careers are discussed.

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